TECHNOLOGY, NON-MARKET ACTIVITIES, AND HOUSEHOLD PRODUCTIVITY

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I. The Relevance of Household Studies and Non-Market Production

1. Traditionally, the household has been conceived as a consumption unit, and there has been a sharp separation between production occurring in the market and consumption in the home. In 1934, with the publication of Economics of Household Production, Margaret Reid broke new ground in bringing to light the limitations of this dichotomy between household and market activities, and in demonstrating the economic importance of the family. 1/

2. It is by now agreed by anthropologists and many economists that while households in all societies are units of reproduction and consumption, rural households in the subsistence economies of most developing countries are also the primary units of production and social interaction, "a sort of basic, communal, multi-purpose socio-economic unit". 2/

3. At this point, it is useful to define what is meant by household production. Although the definitions are many and varied, for purposes of discussion household production can be defined as the totality of all market and non-market productive activities performed

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by all members of the household. Market activities include production and sale of cash crops, wage labour, etc. Non-market activities include (a) productive domestic activities (child care, processing and preparation of food for consumption, cooking, provision of fuel and water, making and care of clothing, etc.) and (b) informal income-generating activities (care of food crops and sale of surplus, production of handicrafts, home industries, marketing).

4. Household production and household organization are characterized by the division of labour or specialization between different members of the household. Although cultural differences are extremely important, 3/ certain aspects of the division of labour between men and women tend to be consistent amongst traditional rural households in a number of developing countries. This division of labour "which constitutes the basic principle of economic and social development, has its origin in sexual differentiation" 4/. Thus, women have major responsibility for all domestic activities and a large proportion of informal income-generating activities as described above. In addition, however, rural women in many developing countries also play a significant role in some market activities, eg. cash crop agriculture This sector is characterized by a division of labour which gives men primary responsibility for preparation of the land, including brushing and felling, clearing and plowing of the land, and women primary responsibility for planting, weeding, harvesting, storage and preparation of food.

5. The process of economic development, according to T. Paul Schultz,

generally involves "the transfer of productive functions from small diversified and self-sufficient family units to larger, more specialized production units that are increasingly dependent upon the market for both purchase of inputs and sale of outputs". 5/ This very transformation however, can significantly alter the allocation of household resources, including income and time, not only between market and non-market activities, but also amongst non-market activities. In doing so, economic development generally, and technological innovation specifically, alter the roles of women, as the primary human agents of non-market activities.

6. It is now beginning to be recognized that non-market activities loom "large in the real welfare of most poor people and constitute a significant source of external economies and diseconomies that should be weighed by policymakers". 6/ Ironically, however, rarely does the planning of development programs concern itself with increasing productivity of non-market activities. 7/ For example, the predominant focus of technology in agriculture has been on cash crops rather than subsistence food crops. This was a rational and reasonable decision, taking into account the critical need for increased income from increased yields. However, this does not imply that subsistence food crops should continue to be ignored, especially in view of the fact that the latter are important in terms of family nutrition and that surpluses are often marketed and increase household income. Moreover, very little technology has been applied to the whole range of informal income-earning activities. Finally, the various

"software" components of technology, including training, extension, and credit have generally been directed towards men, not women. As a result of this bias, it has been argued that productivity in the non-market (generally female) range of activities has been low. 8/

7. Just as the "transformation" of agriculture, as perceived by T. W. Schultz, has been and continues to be of critical importance to the welfare of rural people, it seems that the time is now ripe to also consider productivity of non-market activities. This is particularly crucial if one acknowledges the importance of human capital development (eg. nutrition, education) which, in the early years of a child's life, and especially in developing countries, is largely the result of inputs at the household level and is closely related to the allocation and value of the mother's time. Moreover, as will be demonstrated below, research has recently been bringing to light the potential importance of informal income generating activities.

8. Just as non-market activities have been neglected in the formulation of development programs, they have also received insufficient attention in research directed towards the analysis of the impact of development and technological innovation.

9. This is not to say, however, that the household has been entirely ignored by the academic community. As Theodore Schultz points out, because the family is one of the basic social institutions, "there

has been persistent concern with respect to marriage, procreation, and children. The family is for these reasons a concept that is basically in the domain of anthropologists, of sociologists, and of legal scholars, and all of them contribute to demographic studies". 9/

10. Furthermore, scholars from a variety of disciplines in the Soviet Union, Western Europe, North America, and, more recently, the developing world, have carried out time allocation studies at the household level, which, in several cases, have included an analysis of non-market activities. 10/

11. The most recent development in the economic literature related to household behaviour is that area of theory and research embodied in the "New Household Economics". The basic premise of the NHE is that the household, as a unit, maximizes its utility or satisfaction through a combination of goods and services including children, food, education, etc. This maximization of utility by the household is subject to two types of constraints: an income constraint and a time constraint.

12. The NHE is an outgrowth of the concepts of human capital and of the value of human time. "It provides a comprehensive approach to the non-market activities of the household". 11/ It can be very useful as it provides insight into the human agents in development. Furthermore, the NHE is potentially very valuable in developing countries because it focusses on the household - the seat of most productive activities- and

on time - a major resource available to developing country people.

13. The value of household studies which include an examination of the non-market activities which are normally ignored in economic analysis can best be demonstrated by reference to particular ongoing research projects which are concerned with two critical development issues: poverty and human capital formation. The methodology employed in these studies is an analysis of time allocation of various members of the family. In the case of the Human Capital Formation Studies, the NHE framework has been applied. The Poverty study, by contrast,utilizes the more traditional time-budget methodology.

A. Poverty

14. The "Rural Poverty Study" (Purdue University and several Brazilian institutions) of 960 households (five samples from three areas of Brazil) analyses in detail participation of low income groups in rural labour markets. The study shows that farm people engage in more agricultural and non-agricultural (domestic service, informal income generating activities) than farm management surveys usually pick up. This suggests that there may be a variety of opportunities to increase productivity and income in these varied activities with minimum investment and without formal employment creation at least in the short run. 12/

B. Human Capital Formation

15. It has been suggested that the quantity and quality of a mother's

time, as primary agent in household production, is closely related to the welfare and human capital formation within the family. This has been demonstrated by a number of nutrition studies carried out as part of the Laguna studies in the Philippines. For example, Gonzalo's study indicates that an increase in the educational level of the mother (i.e., an increase in the value and quality of her time) is associated with a significant increase in Vitamin A intake. Moreover, there is a negative correlation between mothers' education and consumption of starchy staples, the latter category of food being considered inferior in terms of nutritional content. 13/

16. Furthermore, both Gonzalo and Popkin 14/ have found that maternal working status in poor households is negatively associated with Vitamin A intake. One could hypothesize that this is related to the quality of intra-household substitutes of time for food preparation. With the mother away from home, it is possible that the production of Vitamin A through time-intensive vegetable dishes is not done as regularly by the mother's substitute (eg. older female children). Predictably, the working status of women is related to higher consumption of cereals and tubers, which are relatively easier to prepare.

17. Finally, earlier studies by Popkin pointed to the importance of the location and compatibility of the mother's job to nutritional status of children. For example, labour force participation, generally, and compatibility of the job specifically, are probably related to the

decision to breast feed, which, according to current wisdom, is positively related to the nutritional status of children, especially in relatively poor societies where adequate substitutes to breast feeding are not readily available or affordable.

18. A caution should be introduced at this point. It should be born in mind that these studies are pioneering ones, tend to be rather weak methodologically, and clearly need a great deal of revision. The relationship between maternal labour force participation and nutritional status is much more complicated than is implied above. Whereas absence of the mother from the home can have negative effects on the quality of food consumed, her working status, on the other hand, augments the income of the household, and, it is generally accepted that increased income is related to higher nutritional status. Also, whereas the short run consequences of maternal labour force participation may tend to be negative, in the long run labour force participation may be related to declining fertility and subsequent increases per capita food input due to smaller family size.

19. Notwithstanding these reservations, a number of important hypotheses have been generated in the nutrition household studies. As T. Paul Schultz points out, if the welfare of the family depends "in substantial part on the quantity and quality of the time a woman allocated to particular domestic activities, there is a reason to believe that this complex of residual household production activities are potentially of great social consequence" 15/

II. The Impact of Technological Innovation on Non-Market Aspects of Household Production

20. Although very little research has been directed towards an assessment of the impact of technological innovation on non-market (especially women's) activities, the following case studies represent pioneering efforts in this direction. Like most pioneering efforts, these studies tend to be either weak methodologically or incomplete. However, they are important because they provide a fresh perspective on technological impact research.

A. Agricultural Development

21. One of the most commonly articulated views in the women's literature is that development and development projects have an adverse impact on the roles and status of women.[16/] More specifically, many writers hypothesize that agricultural development projects lead to an increase in women's work load while that of the man is reduced. Dunstan Spencer summarizes the argument as follows:

> ".... agricultural development projects introduce improved practices into farming systems such as seed, fertilizer, farm mechanization and irrigation. However, improved agricultural inputs are usually introduced by men, saving men's labor, while women are called on to increase their labor input in order to weed the expanded acreage and harvest and process the expanded output. In summary, it is hypothesized that the work load of men remains constant or is reduced while the work load of women is increased as agriculture becomes more commercialized" [17/]

22. In an economic study entitled "African Women in Agricultural Development: A Case Study in Sierra Leone", Spencer provides an empirical test of the above hypothesis using the Integrated Agricultural Development Project (I.A.D.P.) in the eastern province of Sierra Leone. The author concentrates on the inland swamp development component of the I.A.D.P. Farmers participating are given development loans (tools, equipment, cash). The cash component is issued to cover the cost of labour for the very labour demanding tasks of bush clearing, bunding and digging of water channels as well as other land preparation activities. Seasonal loans are also available upon request to cover the cost of improved seed, fertilizer and chemicals supplied. In addition to receiving credit, farmers also receive training and technical advice.

23. A major feature of the program is a shift from upland rice to swamp rice farming. This switch has important implications for labour utilization since swamp rice farming is much more labour intensive than upland rice farming. 18/

24. The methodology employed by Spencer involves a study of 23 households in one village (Benduma) in one of the three operational areas of the I.A.D.P. The households are divided as follows:

Group A - 9 non-participant households (no land development activities)

Group B - 7 first year participating households (major land development activities)

Group C - 7 second year participating households (minor land development activities)

25. In order to contrast the labour force participation of men, women, and children (male and female) of the different types of households, the author conducted time allocation studies of all households, differentiated by members of the household, type of activity, and season. The results are summarized in Tables 1, 2, and 3.

26. Table 1 summarizes the distribution of family labour by enterprise. The information confirms the commonly stated hypothesis that men provide a higher proportion (70%) of the labour input in export crop cultivation (oil palm, cocoa, coffee), while women provide a higher proportion of the input in traditional food crop production (upland rice). However, it should also be noted that both men and women devote the greatest part of their time to the crop being developed (swamp rice), thus, according to Spencer, refuting the hypothesis that women do not use or benefit from the improved technology introduced by agricultural development projects.[19/] However, as will be shown below, this is not as clear cut as it would appear.

27. Table 2 demonstrates the division of labour by type of activity. Spencer points out that the most important farming activity for all types of household labour for participating and non-participating households was land preparation and planting. Women allocate a slightly higher proportion of their time to this activity than men. The second most important job is weeding and underbrushing. This is followed by brushing and felling of trees for men, and harvesting for women.

TABLE 1

Allocation of Family Labor Time [a/] in Farm and Rural Non-Farm Enterprises by Men, Women and Children in Participating and Non-Participating Households in I.A.D.P. Sierra Leone, 1974-1975

(Average per Household, per Month)

Enterprise	Group A Non-participants				Group B First Year				Group C Second Year			
	Male		Female		Male		Female		Male		Female	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Total Hours	150	26	151	4	178	20	165	16	237	122	282	19
Percent Allocated to												
Upland Rice	42	44	47	53	13	30	27	29	9	16	13	10
Swamp Rice	19	12	12	0	62	51	46	60	52	47	48	66
Oil Palm [b/]	1	0	0	0	5	6	0	0	21	20	5	1
Cocoa/Coffee	24	31	7	24	7	9	1	0	2	0	2	2
Other Farm	2	8	8	12	4	2	11	3	8	9	15	11
Non-Farm	8	4	12	6	6	1	8	3	5	4	7	6
Sold Out	4	2	13	6	3	1	6	5	3	3	10	4
Total	100	101	99	101	100	100	99	100	100	99	100	100

[a/] Includes only people normally resident in the household, i.e., does not include family members who were resident outside the village for extended periods but returned and owrked with the household periodically

[b/] Includes harvesting of wild oil palm

Source: Field Survey

TABLE 2

Allocation of Family Labor Among Different Farm Activities [a/] by Participanting and Non-Participating Households in I.A.D.P., Sierra Leone, 1974-1975

(Average Per Household, Per Month)

Activity	Group A Non-Participants				Group B First Year				Group C Second Year			
	Male		Female		Male		Female		Male		Female	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Total Hours	132	110	25	3	162	141	19	15	218	234	113	17
Percent Allocated to												
Brushing & Felling	21	0	18	0	18	0	15	0	15	4	9	0
Clearing	8	2	3	0	5	2	3	9	2	1	2	1
Land Development	0	0	0	0	7	1	9	0	2	1	0	1
Land Preparation and Planting	26	32	23	20	43	47	46	80	43	50	37	62
Weeding and Under-brushing	21	29	19	33	8	12	12	3	18	11	24	16
Pest Control	7	3	14	0	4	0	11	0	3	2	12	0
Harvest	12	23	9	7	8	23	3	4	6	12	6	9
Other Farm	5	12	13	40	7	14	2	3	10	19	10	12
Total	100	101	99	100	100	99	101	99	99	100	100	101

[a/] Does not include non-farm activities and labor sold out.

TABLE 3

Seasonality of Farm and Non-Farm Work by Family Members in Participating and Non-Participating Households in I.A.D.P. Sierra Leone, 1974-1975

Average Hours of Work [a] Per Household Member

Month		Group A Non-Participants				Group B First Year				Group C Second Year			
		Adult		Child		Adult		Child		Adult		Child	
		M	F	M	F	M	F	M	F	M	F	M	F
May	1974	67	46	19	97	187	96	215	99	167	139	176	136
June	1974	147	140	70	90	231	145	272	156	162	156	156	149
July	1974	114	145	90	108	228	153	232	141	232	143	168	100
Aug.	1974	141	164	200	119	268	144	289	110	201	211	193	117
Sep.	1974	93	114	62	34	207	116	260	85	137	143	185	74
Oct.	1974	68	106	28	35	140	80	196	63	92	89	121	52
Nov.	1974	67	106	85	28	124	97	219	25	84	83	108	52
Dec.	1974	68	54	131	0	134	80	160	18	66	60	111	64
Jan.	1975	70	74	76	0	151	87	173	0	82	60	114	16
Feb.	1975	81	41	73	0	131	52	176	0	69	34	55	23
Mar.	1975	60	18	35	0	102	19	161	0	95	22	82	6
Apr.	1975	51	29	85	0	125	36	152	3	85	28	88	2
May	1975	74	48	183	0	103	20	115	0	80	28	67	23
Average		85	84	88	38	164	87	202	54	119	92	125	63

[a] Child hours have not been adjusted to man-hour equivalents

Note: Month of peak load underlined

Source: Field Survey

28. Brushing and felling, clearing and land development are male dominated activities. Interestingly, both weeding and underbrushing and pest control, which are usually regarded as women's work, are characterized by significant male input. Even in harvesting, which is almost universally considered a woman's activity, adult women provide only 60% of total family labour input. This distribution of family labour represents a case quite different from the more clearly demarcated division of labour which has been described in other traditional rural societies, and underlines the danger of generalization.

29. Finally, Table 3 shows the seasonality of farm and non-farm work by family members, and tabulates the average hours of work by month per household member. The most significant trend uncovered is that the average number of hours worked is higher among participants (especially first year or Group B households) than among non-participants. Interestingly, however, the average hours of work performed by women increases only 4% between A and B and a total of 10% between A and C. By contrast, the correspondingly percentage increases for men are 93% and 40%. Significantly, it is male children that demonstrate the greatest increase in their work load. These findings, then, refute the hypothesis that development projects place an uneven burden on women vis-a-vis men.

30. What are the implications of this reallocation of time of household members for household productivity? Unfortunately, the author does not ask, let alone answer, this question. In addition to collecting information on labour (time) allocation amongst household members,

Spencer indicates that he has also calculated household income by source and its distribution, returns to labour, acreage of fields, tenural status and costs of land improvement, crop yields, etc. Elsewhere Spencer has dealt with these results in some detail. 20/ The value of the time allocation aspect of the study is that it has unearthed a number of effects which should be considered alongside the more commonly analyzed income effects.

31. For example,a number of aspects of the changing roles of women should be taken into consideration. Despite the fact that women's average hours of work for total farm and non-farm activities did not increase as much as men's or male children's, "the proportion of female labor devoted to non-farm activities is higher among non-participating than participating households", 21/ i.e., technological innovation has encouraged a shift from non-farm to farm activities for women. Non-farm activities, as defined by Spencer, include such work as food processing, gathering of firewood, clothwork and trading. Assuming that clothwork and trading derive income for the household, any loss in this "informal" income must be considered against any possible gains associated with increased yields of swamp rice.

32. Perhaps a more serious implication of the study is implicit in the fact that domestic activities carried out by women and girls, such as preparation of meals and child care, are excluded from the figures. Table 3 demonstrates that on average each woman and each female child

in Group C devotes 8 and 25 hours respectively more than her counterpart in Group A. At least part of this time has been deflected from domestic tasks. If, as Evenson and Gonzalo suggest, 22/ level of nutrition of a household is closely related to time spent in food preparation, then the opportunity costs of female time deflected to farm work should be considered in studying household productivity increases associated with the I.A.D.P. project.

33. Finally, an important element which should not be overlooked is the dramatic increase in time devoted to farm and non-farm work by children, especially male children. This increase could imply a severe reduction in time devoted to educational activities, including attendance at school and homework. If one is concerned with long term productivity this should be weighed carefully against increased income accruing from agricultural development.

B. Introduction of a Corn Mill

34. In a descriptive, anthropological study, Elizabeth O'Kelly describes the impact of the introduction of a corn mill in several villages in the Cameroons. 23/ This study, although it does not contain any hard, quantified data, is interesting because it describes the impact of technology specifically directed towards a domestic activity performed by women.

35. One particularly time-intensive activity performed by women in

traditional rural societies of several developing countries -including the Cameroons- is the grinding of maize into flour. In order to alleviate the burden of women, a cast iron corn mill developed in England and costing £20 was introduced into the village of Kimar. After initial unwillingness to accept this technological innovation, women in the village began using the mill."The women's boasts of its prowess coupled with rural curiosity soon began to bring sightseers from all over the area and very soon there were requests from other villages to set up corn mill societies there". 24/ Loans were granted and the women were expected to pay these back. By charging a fixed sum a head per month, by the end of the first year 30 villages had repaid the loans and more mills were purchased.

36. O'Kelly analyses the impact of this technological innovation by describing how women used their "saved" time and how this alternative use of time affected household welfare. Prior to the introduction of the mill the people lived in family compounds rather than closely knit villages, and women seldom met people outside their family, except on market day. The presence of the mill meant that women saw each other regularly, and as a result of their closer social intercourse they decided to hold regular monthly meetings. These meetings then generated the demand for classes in such subjects as soapmaking and cookery, and eventually for instruction in the broader issues of child welfare and hygiene. Due to the limited supply of teachers, classes could not be held in each village but were held instead in a central village. Desiring to continue classes during the wet season, women in several villages built, with the help of their

husbands, community halls. A secondary benefit of such halls was that the Medical Departments began to use them for regular monthly clinics, which previously had been few and far between.

37. Although O'Kelly has made no attempt at measurement, she indicates that as a result of the training and increased amounts of "foo-foo" available after the introduction of the mill, the nutrition of the families improved:

> "As they began to put into practice what they had learnt, a marked improvement could be seen in their health and that of their children. With "foo-foo" more freely available they put on weight and far fewer babies died of malnutrition". 25/

C. Introduction of a Road

38. In a descriptive anthropological paper entitled "The Dilemma of Peasant Women: A View from a Village in Yucatan",26/ Elmerdorf explores the effect of the opening up in 1973 of a road on the roles and entrepreneurial behaviour of women in the Mexican village of Chan Kom.

39. It should be pointed out at the outset that Elmendorf's paper is a very brief and cursory description. The author has recently published a book which promises to go into much greater detail. 27/ This has been ordered, and, upon its arrival, hopefully this section can be elaborated.

40. Labour in Chàn Kom is divided in such a way that men work in the fields whereas women work in the home - undertaking the usual household tasks as well as making and selling handicrafts. It is changes in the latter activity which the author describes.

41. According to Elmendorf, women have always recognized that they could get higher prices for their handicrafts (mainly embroidery and hammocks) by selling them to tourists or tourist shops in the neighbouring village of Chichen Itza rather than by selling them to the middlemen who come to the village. In fact, many women found it worthwhile to walk the three hour journey to Chichen Itza. Although Elmendorf makes no attempt at quantification, she asserts that since the road has made the trip to the tourist village less arduous and time-consuming, more women are avoiding the middlemen and deriving more income from their goods.

42. Perhaps even more significant is the fact that the women are apparently now expressing an interest in establishing cooperatives for their handicrafts. "These women believe that setting up a cooperative could help increase their total production and at the same time ensure more equitable prices for their crafts". 28/ This example of women's acceptance of change and willingness to adapt disproves the commonly held hypothesis that peasant women do not respond to the introduction of technology.

43. A second effect of the opening up of a road into Chan Kom is

that certain aspects of the more modern world have been introduced into the village. For example, households have already contributed both labour and money to bring electricity into the village, and three television sets are being shared at ten centavos a viewing! Elmerdorf does not describe any other changes associated with electrification. Hopefully, when I gain access to the author's new book, more light will be shed on this matter.

44. Another effect of opening up Chan Kom to the outside world has been to stimulate migration from the village to Can Cum, a newly established Caribbean resort. Elmendorf has described the fate of the fifty people who have migrated (incl. 18 women) but has not described changes in household organization in the villages as a result of their departure. Again, hopefully, the fuller study will describe the impact in more detail.

45. Based even on Elmendorf's cursory description, it would appear that the introduction of the road has an interesting impact on the roles of women and on household productivity. If one measure of increased household productivity is increased income, then it would seem that the productivity of handicraft marketing has increased as a result of one form of technological innovation. Based on Elmendorf's paper, there is no way of assessing the impact of a secondary innovation, electrification, on the household. Depending on the extent to which electricity is applied, electrification could have significant impact on income, employment, nutrition, fertility, etc. (see concluding section of paper).

46. Elmendorf's description points to several implications for policy. For example, it is likely that the establishment of a cooperative for handicrafts could be made much more profitable if the women concomitantly had access to the technical marketing knowledge and credit necessary to compete in local and regional markets.

III. Technology and Household Productivity: Current Research

47. Current research in the area of technology and household productivity falls into two main categories. Firstly, a number of studies deal with an analysis of the impact of technologies not specifically directed towards non-market activities (eg. commercial agricultural technologies, infrastructure technologies, etc.). For purposes of discussion, these technologies will be called "General Technologies." In this case, analysis is made of the "indirect" effects of technological change on family organization, the changing roles of women and the impact of such changes on household productivity. An example of such research is Spencer's study of the impact of agricultural innovation on the time inputs of all household members, including women.

48. The second group of studies is concerned directly with women's work, (i.e. non-market activities) per se. For purposes of discussion, these technologies will be referred to as "Non-Market Technologies". Within this group, some studies (eg. O'Kelly's study of corn mills) look at the impact of technology on household productivity. A larger number of studies examine the nature of women's work, the technology utilized, and the possibilities of improved technologies directed towards these activities.

49. The following descriptions of ongoing or planned research exemplify the two main types of research described above.

A. Impact of General Technology on Household Productivity

i) - Rural Electrification

50. With the support of IDRC, Herrin is presently engaged in the development of a research project to assess the impact of rural electrification in Western Misamis Oriental in the Philippines. In a paper presented at a CAMs Seminar on Labour Supply, Herrin indicated that such impact should be assessed by studying the effect on household production business activities, agricultural production, and distribution of employment.[29/] With regard to household production, pilot studies in Misamis Oriental have suggested that electrification can affect both the time unit of production (it increases the time available for production) and the allocation of time between different types of household activities and between household and market activities. For example, the introduction of the electric flat iron (the most common item first obtained) can save both the woman's time and effort as well as increasing the efficiency with which ironing is carried out. Herrin suggests that this saving of time, in turn, might permit the woman to spend more time on other domestic activities (for example preparation of Vitamin A rich vegetable dishes) or permit her to devote more time to market-oriented activities. The implications for both nutrition and increased income are obvious. Furthermore, Herrin suggests that the provision of electric lighting could lengthen the unit of time for productive activities, thus releasing more time for both domestic and market activities. About this, however, I am somewhat doubtful; for, at least in some developing countries, simple oil lamps, candles, or the like, already lengthen the hours for productive activity until well after sunset.

B. Women's Work and Non-Market Technology

51. Three planned action-oriented, time allocation household studies will examine the nature of women's work, the technology employed, and the possibilities for improving household productivity through the introduction of more appropriate technologies.

i) - An action-oriented study of the role of women in rural development

(Scarlett Epstein and Ranjit Senaratne, I.D.S., Sussex)

52. The primary areas of concern to be investigated are rural women's contribution to market and household activities, extension services and their adequacy, the contents of present programs of rural women, and the function of education (formal and informal) in the continuation of role differentiation between the sexes. The study will examine the time allocation of rural women in different socio-economic settings (Bangladesh, India, Pakistan, Sri Lanka) and will describe the technology employed in each productive activity. Such information, according to researchers, will permit the formation of policy recommendations for introduction of more appropriate technologies to increase the productivity of female labour and to reduce its inputs in household chores. Research teams composed of developing country scholars will then work with female extension workers in the introduction of appropriate innovations directed towards rural women. It is expected that such innovations will be developed with the assistance of I.T.D.G.

ii) - Technological change and the condition of rural women
(ILO, Geneva)

53. The objectives of this project include (a) an assessment of the impact of technological change (types not specified) on women's income-earning activities including agriculture and food processing, crafts and home-based industries, marketing, etc.; (b) the identification of time-saving technologies for non-monetized types of activities which would liberate female labour for possible income-earning activities; (c) the identification of technologies which would create new possibilities for women to earn money incomes; (d) the identification of priorities and trade-offs between the above technologies; and (e) the identification of programmes and policies which would assist in reducing the gap in productivity between men and women in agricultural production.

54. The first year of the two year project will be devoted to developing a conceptual framework. During the following year, field surveys will be undertaken in countries not yet specified. Apparently the results obtained are expected to assist in the formulation and design of technical assistance programmes directed towards rural women.

iii) - A proposal to study the ways in which intermediate technology can help rural women in the Third World
(Development Associates Institute, (DAI) Washington)

55. The goals of this project are: (a) to develop a catalogue of

intermediate technology techniques and devices which are currently being used or could potentially benefit rural women; (b) to compare the results of case studies on both successful and unsuccessful attempts to introduce technology to rural women. An examination will be made of how basic constraints to adoption (eg. inability to raise capital) impede the introduction process; and (c) to formulate recommendations for introducing intermediate technology to women, for incorporation in projects directed at the rural sector.

56. A sample of 12 villages in six countries (Upper Volta, Kenya, the Philippines, Korea, Ecuador and the Dominican Republic) will be studied. These will consist of 6 villages with a development project which has an intermediate technology component; and 6 villages without a development project but where intermediate technology is being used. Comparisons will be made between families using and families not using the technology.

57. Finally, a number of projects are currently underway or planned about which I have not yet received detailed information. These include:

- a five-person team touring Africa analysing the state-of-the-art of appropriate technology, much of which concerns women's activities. A copy of the report will be sent to me as soon as it is available. (Development Alternatives Inc)
- a study (Ethiopia) on the impact of introducing clean water supplies into selected villages. A copy of the report will be sent to me when available (ECA)
- impact studies planned in Sierra Leone (oil-presses), Upper Volta and Gambia (hand operated grinding mills) (ECA)

IV. Non-Market Technology: Action Programs of the Donor Community

58. Growing recognition of the importance of non-market activities for household well-being and productivity has prompted many donors to begin thinking about appropriate technologies directed towards women's work. In a recent workshop on Village Technology organized by UNICEF in Nairobi, the position of the several participating donors and African officials was summarized as follows:

> ".... the use of appropriate technologies which can reduce the time and labour content of women's work, which can provide better nutrition, allow more time for child care, and social, educational and income-producing activities, could have a role of incalculable value in the improvement of family life, living standards and child welfare" 30/

59. In fashioning their technology programs, donors have taken into consideration both hardware and software components. Thus, programs are being developed to introduce technology, to train women in its application and utility, to provide information and to make credit available. The current progress achieved to date by the various donors is summarized below: 31/

A. UNICEF

60. The basis of UNICEF's approach to development programs is the provision of basic services to meet the needs of families, including more water in arid or semi-arid areas, more food, education, better health services, improved incomes, etc. In keeping with this approach is UNICEF's preoccupation with appropriate technologies in the fields of provision of water, food preservation, food preparation, and income generating activities.

61. In June 1976, UNICEF, in conjunction with the Youth Development Division of the Kenya Ministry of Housing and Social Services, established a "Village Technology Unit" in Karen, near Nairobi. According to UNICEF officials, "the unit was established in recognition of the fact that whilst much had been written and said about village technology, many of the devices involved were not readily accessible to interested people, and there was need for a demonstration centre where people could see, handle, operate and make their own assessment of the potential advantages and disadvantages of different items." 32/

62. The Unit demonstrates fifty different technologies in three main areas of emphasis: (a) home improvement and the means of reducing the work load on mothers;(b) food production, conservation, preparation and use; and (c) improvement of water supplies.

63. During the same month in which the Unit was established, UNICEF organized a workshop on Village Technology in Eastern Africa. It was attended by government officials from ten African countries and several agencies, including IDRC. 33/

64. As a result of the Workshop and visits to the Unit, requests have been received from African countries for demonstrationa and UNICEF has organized demonstration units in some villages. To date, this has not yet been translated into practical terms. However, apparently UNICEF is now embarking on a $450,000 program to organize more widespread demonstrations, disseminate information, and, in some cases, cover the costs of introduction of technologies.

B. FAO

65. Over the years, FAO has been closely involved in the fields of practical agriculture, fisheries, home economics and nutrition.

66. Current efforts in technology directed towards non-market activities include a project for production of materials directed at trainers and supervisors on home economics for use in rural development programmes. The first two of these "Home Techniques" publications are entitled "Food Preservation" and "Labour Saving Ideas". They consist of illustrated techniques intended for global use, and consequently would need local adaptation in some cases.

67. FAO has an interdepartamental committee on Reduction of Post-Harvest Food Losses and is also working directly in this field through the DANIDA-funded African Rural Storage Centre in Nigeria.

68. Finally, and perhaps most interesting, FAO has been involved in the provision of training and the development of improved technological hardware related to informal income generating activities. An example of one such project undertaken by FAO and ILO in Mali has been described as follows:

> "In order to improve cotton manufacturing the project aimed toward improving the traditional methods of treating and weaving cotton. A small scale village workshop was established and the design of tools was improved. The group of men and women who received training served as trainers in instructing

other persons to develop this activity. Research was completed on new designs and utilizing some traditional motifs of Malian origin. A tie and dye section has been started and many village women's groups are now organized and active in producing cotton fabrics which are sold at village markets and in a small shop in the capital city. A later assignment has been making the uniform for school girls from the improved cotton material. Even the older women are involved in teaching the younger women who desire to learn. A continuing challenge is the instruction on controlling the quality of the products, locating suitable market outlets and in instructing management principals". 34/

C. ECA

69. The African Training and Research Centre for Women (ATRCW) of the ECA has been involved primarily in the software aspects of technology, in this case, itinerant workshops for trainers in home economics and other family-oriented fields. These workshops were organized in response to a request by delegates to the FAO/ECA/SIDA Seminar on Home Economics Development Planning for English-speaking Countries in Africa. This Seminar, held in 1972, emphasized the importance of well trained personnel in African courtries for the planning, implementation and supervision of home economics programmes and other programmes aimed at raising the quality of rural life.35/

70. In addition to the training workshops, other activities are now being carried out by Marilyn Carr, a technologist specialist who has been seconded to ECA by the Intermediate Technology Development Group, (ITDG) in London. Dr. Carr has just compiled and published an annotated bibliography entitled Economically Appropriate Technologies for Developing

Countries. 36/ The references in this bibliography relate primarily to research on the issue of choice of technology, but Dr. Carr has found a paucity of research on the impact of such technology on household productivity.

D. USAID

71. In the fall of 1976, a $20 million grant was approved by USAID for the establishment of an "Appropriate Technology Institute" (ATI). A few weeks ago, the Board was appointed. The Institute is to be a separate and independent body concerned with the indigenous development or transfer of appropriate technology in a wide variety of areas including non-market technology, as defined above. At the present time, Riegelmen, previously of Development Associates Institute, Washington, is writing a paper on technology for women's work which will be utilized for developing guidelines for action.

72. Those involved do not yet have a clear idea of how the Institute will function, or what the priorities will be. I plan to keep myself informed of developments.

E. Volunteers in Technical Assistance (VITA) - Mt. Ranier, Maryland

73. Established in the late 1950's, VITA is a private, non-profit organization of 6,000 volunteers and a professional staff of 20, funded through government, private foundation and corporate grants and by individual contributions. VITA's activities include: (a) the services

of volunteer consultants; (b) the initiation of technical projects (eg, design of solar cookers, pumps, etc.); (c) the provision of technological information; and (d) the publication and dissemination of plans and designs for various technologies.

74. VITA involvement has been in the areas of agriculture, business, education and communication, food processing, housing and construction, medicine and health, water and sanitation. Examples of involvement in the area of household technology include design and/or publications in the use of animal and agricultural wastes to produce methane gas for cooking, in small scale home or village level improvements including latrines, solar water heaters, ovens, food processing and storage techniques, soap making and crafts production.

75. Apparently, however, VITA has not been involved in the actual introduction of technology in a practical sense.

F. Intermediate Technology Development Group (I.T.D.G.) London, England

76. Established in 1965, the main aims of I.T.D.G. are (a) to compile inventories of existing appropriate technologies; (b) to identify gaps; (c) to research into and develop new or more appropriate technologies; (d) to test and demonstrate these technologies in the field; and (e) to publish and disseminate technical manuals. Recently, a new objective has been initiated - to assist in the development of indigenous R and D institutions.

77. A number of advisory panels, including ones on Homestead Technology, Rural Food Technology, and Water, meet a few times a year. They are composed of British "experts". While at ITDG headquarters, I had the opportunity to read through the minutes of the Homestead Technology Panel. The impression I got was that the Panel was aware of the main developments in this area, but seemed to be serving only an information rather than an advisory function.

78. To date, I.T.D.G.'s involvement in household technology has been very limited. Interestingly, Scarlett Epstein plans to utilize their services in the development of technologies associated with her action/research project, discussed above.

V. CONCLUSIONS AND IMPLICATIONS FOR IDRC

79. With respect to research, efforts are at the pioneering stage. All the current or planned research projects described above with the exception of Herrin's study, have been initiated by developed country scholars and donor agencies. Moreover, because there is no well-defined theory of non-market productivity, the studies are all at the conceptualization stage. As befits any embarkation into a new research area, a significant portion of each study will consist of the collection of basic information, i.e., what are the non-market and market activities performed by women and what technologies are now employed in different settings? The collection of this type of information will take at least a year in the studies described It is only after such data is collected that hypotheses will begin to be generated.

80. What, then, should IDRC be doing in this area at this time? It would not be unreasonable to suggest that we should adopt a wait-and-see attitude while other people are collecting the basic information. However, this alternative is not attractive for two reasons: firstly, action programs, and especially action programs in new areas, should not be implemented in a vacuum of research or on the basis of research carried out by a handful of developed country scholars; and, secondly, there are a number of specific research undertakings which IDRC could encourage in this area, and which would complement rather than duplicate

current efforts. These would fall into two categories: impact studies and studies on the changing roles of women.

A. Impact Studies

81. Rather than supporting research on the broad collection of data on all non-market activities, I would suggest that we focus on the impact of particular technologies on both market and non-market activities; i.e., on the totality of household production. In measuring changes in household productivity, I would suggest concentrating on specific variables such as income, human capital development, and fertility. The criteria for selection of technologies for study should be two-fold: (a) the potential impact of such technologies on the income, human capital development and fertility of the household, and (b) the extent to which study of the impact of such technologies has been neglected in the past. The first criterion implies a selection of both general and non-market technologies; the second criterion indicates a greater concentration on non-market technologies. A preliminary trio of techniques for study would include energy technologies, domestic labour-saving technologies, and informal income-generating technologies.

i) Energy Technologies

82. Basic to the functioning of rural households is the satisfaction of minimum energy needs. These include the solar energy needed in crop production, the fuel energy needed to cook foods, or the human, animal or fuel energy expended in work or recreation. One such commercial energy source is electricity.

83. As described above, Herrin is developing a project analysing the impact of electrification on a number of activities including domestic work (which he calls "Household Production"), business activities, agricultural production and distribution of employment. In looking at time allocation amongst domestic activities, Herrin is developing hypotheses related to the correlation between time use and nutrition and income. In a very recently received proposal on the impact of rural electrification in Egypt, Salah El-Zoghby indicates his intention to include an examination of the farmers' wives "attitudes toward utilizing electricity in home affairs and economics". I would suggest that Herrin be encouraged in his endeavours and that El-Zoghby be prompted to examine, not only the attitudes of women, but also the extent to which electricity had been introduced into domestic life, and, more importantly, the implications this has for the reallocation of time and changes in household productivity. Furthermore, both researchers should be encouraged to include an analysis of the impact of electrification on informal income-generating activities. This would round out the income data derived from their analysis of market activities such as commercial agriculture and industry.

84. What I am suggesting, then, is that studies on the impact of technologies should include an analysis of change in both market and non-market activities. Such an approach is the only one which would provide a complete understanding of changes in household productivity.

ii) Labour-Saving Domestic Technologies

85. It has been suggested that in many rural households the most time-consuming domestic activities performed by women are carrying water, carrying fuel, and processing food. It has been hypothesized that technologies developed to reduce the time-intensiveness of such activities could release time which could be devoted to leisure, to other domestic activities, (eg. cooking and child care) to informal income-generating activities, (eg. production and sale of handicrafts) or to formal, market, wage-earning activities, if these are available and accessible to women. The reallocation of time could significantly affect the productivity of the household. Thus, it might be worthwhile to study the impact of time-saving technologies including wells, catchment systems, water pumps, fuel conserving stoves, or electric hot plates where such technologies are in existence.

iii) Informal Income-Generating Technologies

86. Research is beginning to suggest that informal income-generating activities could be potentially very important to the household, especially in rural areas where employment and under-employment in the formal sector are high. Thus, it would be useful to assess the impact of informal income generating technologies on household productivity. An example of such technology, described above, is the introduction of improved techniques for cotton weaving in Mali. It would be interesting to study the extent to which the increased production and sale of cotton fabrics has increased household

income. Moreover, analysis should include the extent to which greater involvement in this activity has changed the woman's allocation of time, and, therefore, other aspects of household production, such as preparation of food and care of children.

B. Studies on the Changing Roles of Women

87. The above impact studies begin by identifying technologies and then analyze the impact of such technologies on household organization and production. This second groups of studies would begin by identifying locales in which the roles of women and changing.

88. Changes in the roles of women reflect changes in household organization and production which result from development and institutional change generally, or technological change specifically. Thus, the changing roles of women reflect the reallocation of household time and income to different market and non-market activities.

89. Studies of this nature would have two aspects: (a) an analysis of the cause of the change - for example, agricultural change (Spencer), the introduction of a road (Elmendorf), the introduction of a corn mill (O'Kelly); and (b) the analysis of the effects of change on all aspects of household productivity, including income, human capital development and fertility.

C. Methodology

90. Because research on the effect of technological change on

household production including both market and non-market activities has been so limited, there has been little development of methodology in this area. However, the most commonly applied methodology is the household time-budget study. In a few cases, it would appear that the NHE is too complex to be used by anyone except an econometrician. However, the more traditional time-budget methodology has been utilized for years by researchers in a wide variety of disciplines. As a tool, it is time-consuming but fairly easy to use. The greatest advantage of the time-budget is that it can capture the whole range of household activities - both market and non-market, and can reflect change following development or technological innovation.

91. Time-budget data, of course, must be supplemented by a wide variety of other information - including household income by activity, level of nutrition (as measured by such indicators as daily per capita intake of calories, protein and Vitamin A, relative magnitude of protein from animal sources and of calories from cereals, roots and tubers, total food expenditure per capita, etc.), demographic characteristics of the household, education of mother and father, etc.

92. Depending on the nature of the study and the specific technology involved, research would have to be carried out by interdisciplinary teams consisting of a combination of economists, anthropologists, and nutritionists.

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1/ Reid, Margaret, Economics of Household Production, Wiley & Sons, New York, 1934.

2/ White, Benjamin, "Problems in Estimating the Value of Work in Peasant Household Economies: An Example from Rural Java", Mimeo, Bogor, February 1976.

3/ Household studies, including time allocation studies, have demonstrated that the division of labour between men and women in traditional rural households of developing countries varies from culture to culture. Thus, the division of labour in a Ghanaian family in which the woman engages heavily in market activities outside the home, will differ significantly from a Moslem household in Morocco where the woman is confined to the home.

4/ Olin, Ulla, "A Case for Women as Co-Managers: The Family as a General Model of Human Social Organization", in Tinker, Irene and Bramsen, Michele Bo, Women in World Development, AAAS, Overseas Development Council, 1976, p. 105.

5/ Schultz, T. Paul, "Preliminary Draft ADC", November 1974, Mimeo, p.1

6/ ibid, p. 1

7/ This is, of course, an over-simplification. Development programs have for many years concerned themselves with certain aspects of non-market activities, especially in the areas of nutrition and fertility. The same cannot be said, however, of the whole range of other domestic and income-generating non-market activities.

8/ Economic Commission for Africa, "Women and National Development in African Countries: Some Profound Contradictions", in African Studies Review, Vol. XVIII, No. 3 (Dec.1975), pp.47-70

9/ Schultz, Theodore W., "Fertility and Economic Values", in Schultz Theodore W. (ed.) Economics of the Family, The University of Chicago Press, Chicago and London, 1974, p. 11.

10/ The history of time allocation studies has been a long and evolving one.

Towards the end of the nineteenth century, Frederick Taylor conducted intensive time-and-motion studies of factory work in England. These studies were only concerned with hours of work on the job.

The first 24 hour accounting of time, both on and off the job, was carried out in the Soviet Union in 1924. This was the first time budget data which served later as a basis for historically retrospective comparative analysis of changes in living conditions of a population. (See Szalai, Alexander, "Trends in Comparative Time-Budget Research", in American Behavioural Scientist, Vol 9, 1966)

In Western European and American Sociology, time allocation studies were applied most extensively in the area of leisure time. One notable exception to this in the U.S. was a series of studies about the use of time by farm women, carried out in the late twenties by the Bureau of Home Economics of the U.S. Department of Agriculture. (I have several of these studies on file). Another important development were the studies (still ongoing) at Cornell University on the allocation of women's time amongst domestic activities. These studies are important especially with respect to the development of time-budget methodology. (Several studies on file)

During the 1960's the Soviet Union again conducted very intensive 24-hour time allocation studies. According to Szalai, one of the fundamental purposes of this study was to assist implementation of policies which would permit rationalization of household activities, thereby releasing women to work in the labour force, which was at that time in short supply.

Finally, between the mid-sixties and the present time, a growing body of theoretical and empirical research has been developing in the area of the "New Home Economics" (NHE). This economic research has focussed on the household as a unit of production which maximizes its utility or satisfaction through a combination of goods and services, including children,. food, education, etc. A central contribution of the NHE is its preoccupation with the household's time constraint, Thus, an important characteristic of the NHE studies in the analysis of the time allocation of all members of a household over a 24-hour period. Such analysis provides a very clear picture of the division of labour between men and women (and children). (See my trip report on ADC Workshop in Household Studies in Singapore, August 76, for a description of the conceptual framework of the NHE).

11/ Schultz, Theodore W,, op.cit. p. 7

12/ This section will be expanded upon receipt of the report of this study.

13/ Gonzalo, Susan, "Major Factors Affecting Rural Household Food Consumption", Discussion Paper No. 76-13, Institute of Economic Development and Research, School of Economics, University of the Philippines, July 26, 1976.

14/ Popkin, Barry, "The Production of Child Welfare in Rural Filipino Household", Discussion Paper No. 76-17, Institute of Economic Development and Research, School of Economics, University of the Philippines, July, 1976.

15/ Schultz, T. Paul, op. cit. pp. 1-2

16/ See especially Boserup, E., Woman's Role in Economic Development, London, George Allen and Unwin Ltd., 1970, and Tinker, I., "The Adverse Impact of Development on Women", in Tinker, I., and Bramsen M. B., Women in World Development, op.cit., pp.22-34

17/ Spencer, D. S. C., "African Women in Agricultural Development: A Case Study in Sierra Leone", Overseas Liaison Committee, American Council on Education, Washington, June 1976, pp.1-2

18/ Spencer, D. S. C., "The Economics of Traditional and Semi-Traditional Systems of Rice Production in Sierra Leone", Proceedings of the WARDA Seminar on Socio-Economic Aspects of Rice Cultivation in West Africa, Monrovia, Liberia, 1974.

19/ See ref. #16

20/ Spencer, D. S. C., op.cit. (ref. #17)

21/ ibid

22/ See section on Human Capital Formation above.

23/ O'Kelly, Elizabeth, "The Corn Mill Societies", in Aid and Self Help, Charles Knight & Co. Ltd., London and Thornbridge, 1973

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24/ ibid, p. 111

25/ ibid, p. 114

26/ Elmendorf, M., "The Dilemma of Peasant Women: A View from a Village in Yucatan", in Tinker, Irene and Bramsen, Michele Bo., op.cit. pp.88-94

27/ Elmendorf, Mary, Nine Mayan Women: A Village Faces Change, New York, John Wiley and Sons, 1976

28/ Elmendorf, Mary, op.cit. (ref.#26) p. 92

29/ Herrin, Alejandro, "The Employment Effect of Rural Electrification in Western Misamis Oriental", Paper presented at the Seminar on Labour Supply under the joint sponsorship of the Council for Asian Manpower Studies and the Organization of Demographic Associates held in Makati, Rizal, Philippines, from June 21-25, 1976

30/ McDowell, Jim, (ed) Village Technology in Eastern Africa, A Report of a UNICEF sponsored Regional Seminar on "Appropriate Technology for the Rural Family" held in Nairobi, 14-19 June, 1976, UNICEF, Eastern Africa Regional Office, p.7

31/ Detailed information is available on file and will continually be updated

32/ McDowell, Jim, (ed) op.cit. p. 37

33/ IDRC was represented by Chandler and Freeson

34/ Hahn, Natalie, Home Economics Officer, FAO, "Ways and Means of Alleviating the Heavy Tasks of the Farm Household", paper presented at the National Farmer's Training Workshop, Debre Zeit, Ethiopia, November 22-December 3 1976, p. 5

35/ UNECA, FAO, "Report of Missions to Review and Follow up the Results of Itinerant Training Workshops Evaluation Services" No. 1, 1976.

36/ Carr, Marilyn, Economically Appropriate Technologies for Developing Countries An Annotated Bibliography, Intermediate Technology Publications, London, 1976